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C&SF RESTUDY ALTERNATIVE EVALUATION TEAM REPORT ON THE PLAN FORMULATION STARTING POINT

Prepared by the C&SF Restudy's Alternative Evaluation Team

Introduction

The Central and Southern Florida (C&SF) Project Restudy created an Alternative Evaluation Team (AET) for the purpose of evaluating the effects from a number of alternative plans, as a basis for developing the Comprehensive Plan for the C&SF Project. The objective of the AET evaluation process is to identify the plan (or plans) which best meets the regional restoration and sustainability goals set by the authorizing legislation for the C&SF Project, and the Conceptual Plan of the Governor's Commission for a Sustainable South Florida. The optimum components in a Comprehensive Plan are identified by means of an iterative evaluation process, whereby different combinations of these components are sequentially modeled and evaluated relative to a set of pre-determined performance measures. Components which substantially improve on base conditions, or which meet performance targets, are carried forward in the iterative modeling and evaluation process, while components which fail to perform well may be modified or rejected.

The AET is an ad hoc team, established by the Restudy for the specific purpose of evaluating a large number of alternative plans during a definitive planning process. The plan evaluation process is scheduled for September 1997 through April 1998. This report presents a summary of the conclusions of the first plan evaluation meeting of the AET, held 9-10 October 1997. At this meeting, the AET evaluated the Starting Point model simulation (summarized below). The core of this report is a set of evaluations conducted by eight subregional and issue subteams of the AET, relative to the Starting Point, and recommendations from these subteams and the full AET for improvements in performance required during subsequent plan simulations. This report also includes recommendations for improvements in the plan evaluation process, for incorporation in future evaluation cycles.

Methods

The AET is a multi-agency, multi-disciplinary team, consisting of about 30 members. The AET is divided into eight subregional and issue subteams, each with a chair or co-chairs (Kissimmee/Lake Okeechobee, Lake Okeechobee Service Area, Lower East Coast, Central Everglades/Everglades National Park, Estuaries and Bays, Big Cypress, Total Systems, and Water Quality). During each evaluation cycle, each subteam

has the lead responsibility for collecting all evaluations submitted to the AET from any non-AET source, which are applicable to the subregion and issues being addressed by that team; additionally, each subteam performs its own evaluations. The subteams synthesize all evaluations into subteam reports to the full AET during each evaluation cycle.

Plan evaluations conducted by the subteams and the full AET are based on, (1) a set of pre-determined, hydrological performance measures, and (2) output from landscape-scale, ecological and water quality models. Each performance measure identifies specific hydrological targets, based on ecological, water supply, flood control and water quality objectives established for the C&SF Restudy. These hydrological targets have been defined in large part through the development of a suite of conceptual ecological models for the south Florida wetland landscapes, the draft Lower East Coast Regional Water Supply Plan, and the Lake Okeechobee Regulation Schedule Study. Performance measures may be added or deleted from the set used by the AET, based on recommendations from the subteams and approval by the full AET. Each alternative plan is evaluated based on the success of that plan in meeting the targets established by the performance measures. The hydrological performance of each plan is reported on the public web site during each evaluation cycle.

In addition to the performance measures, the AET may use output from three landscape scale models, the Across Trophic Level System Simulation model (ATLSS), the Everglades Landscape Model (ELM), and the Everglades Water Quality Model (EWQM). These models will be used to compare effects from alternative plans against either the current base (1995) or future "without project" base (2050). Summaries of output from these models, as it becomes available to the AET, will be reported in the AET evaluation reports.

Evaluations submitted by a subteam to the full AET, whether originating from the subteam or from an outside evaluator, are framed within the context of one or more performance measures. The full AET, during its meeting, synthesizes the subteam evaluations into a set of summary, "highlights" statements. These highlights statements are intended to describe the major strengths and weaknesses of the plan under current review, relative to the targets set by the performance measures. The highlights statements are provided to the Alternative Development Team (ADT) as a basis for designing the next alternative plan.

In addition to the brief, highlights report, the AET prepares a written report of each evaluation cycle. The written reports include short narrative summaries from each subteam, a list of the performance measures used by the subteams during that evaluation cycle, and recommendations for future plans and to the evaluation process.

Evaluation of the Starting Point

Plan Components

The following components are those which were included in the Starting Point hydrologic simulation by the South Florida Water Management Model (SFWMM):

1. A Storage Reservoir (10,000 acres at 10' maximum depth) north of Lake Okeechobee.

2. A Storage Reservoir (5,000 acres at 4' maximum depth) in the St. Lucie basin.

3. A Storage Reservoir (10,000 acres at 8' maximum depth) in the Caloosahatchee basin.

4. Current Lake Okeechobee Regulation Schedule.

5. A Storage Reservoir (40,000 acres at 6' maximum depth) in the Everglades Agricultural Area (EAA).

6. Draft Lower East Coast Regional Water Supply Plan Alternative 5 Operational Rules for deliveries to the Water Conservation Areas (WCAs) and Everglades National Park (ENP).

7. Water Preserve Areas / Site 1 (1,660 acre at 6' maximum depth) in western Palm Beach County.

8. Broward County / WCA-2B Seepage Management.

9. Water Preserve Areas / C-11 Storage (1,600 acre at 4' maximum depth) in Broward County.

10. Water Preserve Areas / C-9 Impoundment (2,500 acres at 4' maximum depth) in Broward County.

11. 12,800 acre subterranean seepage barrier in Dade County (Central Lakebelt).

12. Water Preserve Areas / Bird Drive Impoundment (2,877 acre at 4' maximum depth) in Dade County.

13. Dade County / L-31N Seepage Management.

Starting Point Highlights

The following highlights represent the major strengths and weaknesses of the Starting Point, as evaluated by the AET:

A. Total System

Note: Hydroperiods improved for the ENP, but are still too short.
Rationale: The Starting Point helped hydroperiods in ENP but they are still not meeting NSM. The Starting Point made more of a difference in the ENP than anywhere else, but hydroperiods still don't meet NSM.

Note: Stages are too high in some areas, near zero seepage, and groundwater flow zones appear impacted.
Rationale: Many acres in 2B and 3B were over NSM in ponding depths, much worse than 1995 and 2050 (possibly because of 100% seepage control?). Curtain walls create the potential for limiting operational flexibility.

B. Kissimmee / Lake Okeechobee

Problem: The Lake is too low (<11 ft) for too long (400 days).
Rationale: The 2050 base results in harmful prolonged low stages (<11 ft for up to 400 days), as a result of increased water demands in the 2050 base condition, that were not observed in the 1995 base. The Starting Point does not fix the problem.

Note: The Starting Point improved the median duration of high stage events compared to the 1995 and 2050 base conditions, but continue to include one prolonged (>15 ft for 900 days) event. This may not be a problem that must be "fixed" by ADT since it reflects an atypical high rainfall period.

Note: Performance does not resemble the '53-'73 period.
Rationale: The overall pattern of water level variation in the Starting Point does not resemble the restoration goal (the 1953-72 historical pattern). Performance measures moved only slightly in the desired direction.

Note: No performance measures were evaluated for the Kissimmee.

C. Lake Okeechobee Service Area

Problem: To meet 1-in-10 water supply (as indicated by lake supply-side management).
Rationale: In the Starting Point, water use restrictions in the Lake Okeechobee Service Area occur with a frequency of between 1 in 5 and 1 in 3 years. In several years, the water available for delivery is severely limited by extremely low levels in Lake Okeechobee. In addition, the overall percentage of demands not met is substantial. All

indications are that the State water supply goal of meeting all demands in at least a 1 in 10 year drought are not being met.

D. Lower East Coast

Problem: Too much saltwater intrusion.
Rationale: Compared to 2050, in general, the coastal canals exceed the saltwater intrusion criteria more frequently and for longer periods of time.

Problem: Too many water supply cutbacks, especially in Service Areas 2 and 3
Rationale: The number of locally triggered cutbacks for water shortages increase overall and more so in Hollywood/Ft Lauderdale Airport, and Dade County when compared to 95 Base and 2050, while the number of Lake triggered cutbacks declined when compared to 2050.

Note: High releases to Hillsboro, C-9, and Lake Worth were noted.
Rationale: The volume of water discharged through the Hillsboro Canal, C-9 Canal, and to the Lake Worth Lagoon does not decrease compared to 2050. The releases are still too high.

Note: There were more water supply cutbacks but they were less severe.
Rationale: The number of months of water supply cutbacks improves (# of months declines) slightly in the Starting Point compared to 2050 for the LECSA, but the number of months of water supply cut backs does not improve (# of months increase) when compared to the 95 Base. The volume of the water supply cutbacks increases slightly for Service Area 2, while it declines for the remainder of the service areas.

Note: Dependence on water supply from Lake Okeechobee increased in SA2.
Rationale: Dependence of SA2 on Lake Okeechobee for water deliveries increased over 2050 in terms of the number of days and volume of water delivered. There is a very slight improvement (i.e., decrease in number of days and volume) in water deliveries for SA1 and SA3.

Note: Seepage declines for WCA-2, WCA-3, and ENP.
Rationale: The average annual seepage flows from the WCAs and ENP to the LEC declines significantly for WCA-2, WCA-3 and ENP.

E. Central Everglades and Everglades National Park

Problem: WCA-2B too high all year.
Rationale: Water levels in 2B are way, way too high, all year. The stage duration curve shape is acceptable.

Problem: Too dry downstream of STA 1 west.

Rationale: Loxahatchee National Wildlife Refuge is acceptable, but have to figure out a way to maintain dry season water levels downstream of STA 1 west.

Problem: WCA-3B is too high (need better topographic information).
Rationale: 3B shows destructively high water; this appears to be an unrealistic result. If true, it needs to be brought down.

Problem: Shark River Slough hydroperiods are too short.
Rationale: Shark River Slough hydroperiods are too short under the Starting Point.

Problem: WCA-3A too dry in dry season.
Rationale: Central 3A may be drying out, need enhanced performance measures.

Problem: NW WCA-3A hydroperiod too short.
Rationale: NW 3A hydroperiods are still too short.

Note: Holey Land may be improved by new regulation schedule.
Rationale: Holey Land hydroperiod is good but high water is too high, the new schedule may help.

F. Estuaries and Bays

Caloosahatchee and St. Lucie:
Problem: To meet minimum flow at Caloosahatchee (300cfs).
Rationale: The number of times low flow discharges were not met increased with the Starting Point. A base flow of 300 cfs is needed to maintain appropriate salinities.

Problem: To meet minimum flows in the St. Lucie Esturay (350 cfs).
Rational: a base flow of 350 cfs is needed to maintain appropriate ssalinity. The number of times this was not met increased with both the Starting Point and 2050 base.

Problem: No regulatory releases from Lake Okeechobee are desired.
Rationale: There was no difference between the Starting Point and the 2050 base case in the number of high discharges and regulatory releases to either estuary.

Lake Worth Lagoon:
Problem: To meet minimum flow to the Lake Worth Lagoon (150 cfs).
Rationale: The C-51 performance criteria indicated the Starting Point reduced flow to Lake Worth Lagoon. However, the target of no regulatory releases has not been met. In addition, an estimated base flow of 150 cfs is needed.

Biscayne Bay:
Problem: The Starting Point Biscayne Bay reduces wet season flows by > 40% and dry season flows by > 50%.

Rationale: A qualitative performance measure for Biscayne Bay is for "more estuarine" conditions to prevail. The Starting Point reduced freshwater inflows more that 40% in the wet and more than 50% during the dry season. The Starting Point does not meet the performance measure. It is moving away from it. Future alternatives should provide annual inflows equal to, or greater than, current inflows, with emphasis on dry season inflows. Dry season inflows should exceed existing mean total inflow of 312,000 acre feet.

Florida Bay:
Note: Frequency of too little water during wet season (too saline) needs to be reduced.
Rationale: Need to increase the frequency that coastal basin salinities drop below the lower salinity values identified for each basin. Do so by raising the P33 stages above the 7.3' MSL during the 48 months of the period of record when the NSM ver 4.5 exceeds that stage but the Starting Point does not.

Note: Frequency of too little water during dry season (too saline) needs to be reduced.
Rationale: Need to decrease the frequency that coastal basin salinities exceed upper limits identified for each basin. Do so by raising the P33 stages above 6.3' during the 92 months of the period of record when the NSM ver 4.5 exceeds that stage but the Starting Point does not.

G. Big Cypress

Problem: Hydroperiod is too long at western boundary of model.
Rationale: Considering cells of uniform habitat, average hydrograph differences show columns 1 and 2 on western model boundaries are too wet.

Problem: Area north of Monroe Station, too long hydroperiod.
Rationale: Hydroperiods of the pine habitats in areas north of Monroe Station are too long, should be 60 days as opposed to 240-360 days indicated by the model.

Problem: Hydroperiod is too long in southwestern area.
Rationale: The southwest prairie area is much wetter in the model than would ever be expected.

Note: Ponding around L-28 moves east.
Rationale: Looking at average annual hydroperiod differences and ponding differences, no difference between 1995 base, 2050 and Starting Point in average annual hydroperiod differences and ponding differences was observed. The Starting Point is generally closer to NSM than the 1995 base or 2050, and therefore is moving in the right direction.

Note: Southeast side has too high peak stages.
Rationale: The 2050 base and Starting Point, both individually and cumulatively, had higher peak stages along the SE edge of Big Cypress, below Tamiami Trail.

Note: Results are mixed on the current performance measure cells, making it hard to suggest changes.

H. Water Quality

Problem: Salinity values to estuaries do not "fit" envelope.
Rationale: No significant difference between the Starting Point and 2050 in terms of meeting salinity targets for the east/west estuaries. Both are far from the target.

Problem: Central glades need to be more NSM-like.

Note: Need more storage to improve water quality; in Taylor Creek/Nubbin Slough for Lake Okeechobee improvements.
Rationale: There are significant water quality benefits to Lake Okeechobee associated with storage in the Taylor Creek/Nubbin Slough basin (in addition to Kissimmee River basin).

AET Subteam Narratives

A. Total System Subregion

Performance Based Comments:

A table summarizing the results of the total system can be found as Attachment 1 to this document.

1. Most of the improvements seen in the Starting Point occur in Everglades National Park where 320,000 acres of marsh showed improved hydroperiods compared with the 2050 base condition. Hydroperiods still did not match NSM, however.

2. WCAs 2B and 3B had large areas that exceeded NSM both in hydroperiod and ponding depth compared with the 2050 base. These areas of too much water are adjacent to the 100% seepage component. When combined with the Lower East Coast's noticeable loss of groundwater on the other side of the seepage barrier, these results suggest that 100% seepage control may create a surplus of water on one side and a deficit on the other.

3. A large number of acres in WCA-3A north had shorter hydroperiods than the 2050 base condition and a nearly equal number exceeded NSM.

Performance Measures and Indicators Used:

1. Mean hydroperiod distribution for the 31-year period of record for the remaining Everglades.

2. Mean NSM hydroperiod grid cell matches for Holey Land and Rotenberger WMAs, the Pennsuco Wetlands, the WCA system, and Everglades National Park.

3. Mean NSM ponding matches for above areas.

4. Hydroperiod improvements relative to the 2050 base for all above areas plus Freshwater Marsh (Shark River Slough).

Recommendations:

1. Hydroperiods in Everglades National Park, for the most part, still need to be increased.

2. Another method of seepage control is needed along WCA-2B and 3B.

3. The extreme conditions in WCA-3A north need to be corrected so that more areas approximate NSM conditions.

Subteam Issues:

1. It was suggested using a system-wide performance measure based on volumes of water sent to tide. The regional subteam agreed to develop a measure based on minimizing excess flows to tide.

B. Kissimmee / Lake Okeechobee Subregion

Performance Based Comments:

No performance measures were evaluated for the Kissimmee River.

Inflows to the Lake were reduced by 37,000 ac ft y^{-1} in the Starting Point scenario relative to the 2050 base condition, but this represented only a 1% change. Outflows from the Lake were reduced by 43,000 ac ft y^{-1} (1%). Evapotranspiration losses from the Lake were increased by 20,000 ac ft y^{-1} (1%). These are very slight changes, and probably fall within the error of the estimates.

The stage duration curves indicate that the Starting Point achieved an overall greater water level regime for the Lake than the 2050 base condition, but lake levels still were lower than under the 1995 base condition. The difference between curves was most pronounced at lower water levels.

The Starting Point scenario reduced from 5 to 2 the number of < 11 ft lake stage events (of duration corresponding to the MFL criterion) and reduced from 2 to 1 the number of < 12 ft events relative to the 2050 base condition. The Starting Point output

was very similar to the 1995 base output for these measures, and was viewed as a plan that did not make conditions better, but simply avoided additional harm associated with low lake levels.

All scenarios gave exactly the same scores for spring lake level recession (36 out of a possible 93 points; with a maximal score occurring if a spring recession, without reversal, occurred inside the "window" every year). The subgroup questioned whether a recession is desired every year, and concluded that a more realistic "target" would be the frequency of specified spring recessions that occurred during the 1953-72 historical period. This would permit scoring in a manner that is consistent with the other measures. Furthermore, additional statistical evaluations are needed to quantify how wading bird foraging and nesting correspond with the spring recession, or water level variations in general. Until this is done, this measure is considered with caution.

The 2050 base condition and the Starting Point scenarios had higher median values and higher maximal values for duration of lake stage events < 11 ft, as compared with the historical reference period. A single event lasting over 400 days appeared to occur due to the increased water demands in the 2050 base condition, and was not alleviated by the features of the Starting Point.

The Starting Point scenario was closer to the 1953-72 historical pattern (the "restoration target") in terms of duration of lake stages below 12 ft than the 2050 base, but was similar to the 1995 base. The Starting Point range (upper end), however, was still quite high relative to the historical reference period.

The Starting Point scenario also was closer to the historical case in terms of median duration of lake stages above 15 ft. However, the maximum duration (900 days) was still quite high relative to the historical. A high stage event lasting this long can bring about considerable harm to the lake's submerged plant community, fishery, and other wildlife. It is unclear whether this event represents a problem that should be "fixed" by the ADT, because it occurred due to an atypical rainfall event.

Performance Measures and Indicators Used:

1. Number of undesirable stage events (duration of lake stage <11 ft, duration of lake stage <12 ft, duration of lake stage >15 ft).

2. Report on mean annual inflows and outflows.

3. Stage duration curve.

4. Daily hydrograph with spring recession windows.

Recommendations:

1. The ADT should address the issue of the Lake being too low for too long.

C. Lake Okeechobee Service Area Subregion

Performance Based Comments:

Total EAA/LOSA irrigation demands and demands not met level of service do not meet Restudy goals. The State's water supply goal of meeting demands in a 1 in 10 year drought is not met by the Starting Point. Examination of the Lake Okeechobee daily stage hydrograph shows that the Lake Okeechobee Service Area is modeled as being under supply-side management for a substantial portion of six (6) dry seasons. In several situations lake levels were very low and under such circumstances little water would be delivered under supply-side management. Furthermore, during four (4) additional years a large portion of the dry season was spent with the Lake level walking the supply-side management line. The frequency of water shortages appears to be somewhere between 1 in 5 and 1 in 3. Total demands not met running more than 10% are also high.

The reservoirs that are components of the Starting Point, appear to be immensely useful overall in meeting Lake Okeechobee Service Area demands but performance measures were not available to determine their specific contributions. St. Lucie and Caloosahatchee reservoirs are reported together and only deliveries from the EAA reservoir to meet EAA demands are reported. The lower demand not met percentage for the Caloosahatchee Basin is likely due to water being available in that reservoir when the Lake service area is in supply-side management.

The threat of high water levels in Lake Okeechobee causing flooding in the Lake Okeechobee Service Area was reduced under the Starting Point. No performance measure was available to indicate whether flood threats within the EAA had increased as a result of the Starting Point. Frequencies and severity of water shortages are much reduced in the Starting Point as compared to the 2050 base condition. This is due to the increased upstream storage capabilities.

Performance Measures and Indicators Used:

1. Lake Okeechobee Daily Stage Hydrograph.

2. Total EAA/LOSA Irrigation Demands and Demands Not Met.

3. Report - Cumulative Total Demand, Cutback Volume and Cutback %.

4. Flood Protection Criteria for Lake Okeechobee.

Recommendations:

More stored water is needed. Backpumping of water (with appropriate quality treatment) from the Caloosahatchee and possibly the St. Lucie Canal Basins into Lake

Okeechobee in conjunction with additional storage capability in the Kissimmee Basin should be considered and substituted for the St. Lucie and Caloosahatchee reservoirs.

D. Lower East Coast Subregion

Performance Based Comments:

In general, few of the performance measures moved towards the goals for the Lower East Coast Subregion. The number of cutbacks increases, salt-water intrusion is more severe and the amount of water delivered from the Water Conservation Areas (WCAs) and Everglades National Park (ENP) declines significantly. The inclusion of 100% seepage control at two places in the levee probably had the greatest impact by reducing the hydraulic head that drives water to the wellfields and Biscayne Bay.

1. Compared to the 2050 base, the coastal canals generally fail to meet the saltwater intrusion criteria more frequently and for longer periods of time.

2. The volume of water discharged through the Hillsboro Canal and to Lake Worth Lagoon remains high compared to the 2050 base. These high releases may represent excess stormwater being released to tide.

3. The number of locally triggered cutbacks for water shortages increases overall compared to the 2050 and 1995 base cases. The increases are concentrated at Palm Beach Gardens, Hollywood, Ft. Lauderdale Airport and Dade County. The number of Lake Okeechobee triggered water supply cutbacks declines slightly when compared to the 2050 base.

4. The number of months of water supply cutbacks improves (# of months declines) slightly in the Starting Point compared to the 2050 base for the LECSA (Lower East Coast Service Area), but the number of months of water supply cutbacks does not improve when compared to the 1995 base.

5. The volume of water supply cut back increase slightly for LECSA2, while the volume of the cut back declines for the remainder of the service areas.

6. The dependence of LECSA2 on Lake Okeechobee for water deliveries increases over the 2050 base in terms of the number of days and volume of water delivered. There is a very slight improvement (i.e., decrease in the number of days and volume) in water deliveries from Lake Okeechobee to LECSA1 and LECSA3.

7. The average annual seepage flows decline significantly from WCA-2, WCA-3 and ENP to the Lower East Coast.

Performance Measures and Indicators Used:

This section under development

Recommendations:

1. Remove or decrease the 100% seepage control at levees. Too much water is being held in the WCA-2B and ENP and preventing flows to southern Broward County and to Dade County wellfields and canals.

2. An increase in canal flows may be needed to offset the reduced flows because of the seepage barrier. In addition, timing water flows to meet salt-water criteria and/or holding it in the system longer by adding control structures and interconnecting canals may reduce exceeding the salt water intrusion criteria.

3. Include remainder of the L-8 option as outlined in the Critical Project including increasing the size of the pumps and canals.

4. Move additional demands on the wellfields west.

5. Increase the use of regional Aquifer Storage and Recovery (ASR) (on C-51 at least) or other method to hold more water in the system east of the levee to increase ground water levels and reduce losses to tide.

6. Additional conservation should be included in future alternatives to reflect the potential decrease in demands obtainable. The inclusion of this component should be in an alternative when the effect would be readily reflected in the performance measures.

Subteam Issues:

1. Suggested performance measures and indicators (not yet approved by the AET):

    a. When describing water deliveries from the regional system to the Lower East Coast, break out deliveries from the Water Preserve Areas.

    b. To determine the impact of salt-water intrusion where there is not an adjacent canal, the changes in groundwater levels near wellfields should be examined and compared against the three runs (1995, 2050 and alternative). Also, the changes in groundwater levels adjacent to the Pennsuco Wetlands and Dade-Broward Levee canal should be examined.

    c. What performance measures address the Lakebelt?

2. General comments and recommendations not related to specific performance measures:

a. Water quality concerns were expressed for placing untreated water in the in-ground reservoir in Dade County adjacent to the Northwest Wellfield. Water quality treatment should be included in the component.

b. To reduce drawdowns to the Pennsuco Wetlands, the Dade-Broward levee canal should be deepened and widened with a control structure at the southern end of the wellfield.

c. Assumptions for ASR in the 2050 base may be overestimated and not realistic. Reducing the diversion of water to ASR may increase flows to Biscayne Bay.

d. A low-tech set of components should be run to understand how the model would respond without additional highly managed components. This may be an appropriate alternative in which to include greater conservation.

e. The modeling scenarios for modified water deliveries to ENP, the additional structure on C-4 and the C-111 project are reasonable.

E. Central Everglades / Everglades National Park Subregion

Performance Based Comments:

1. WCA-2B. Predicted water levels in WCA-2B are Away, way@ too deep under both the Starting Point and the 1995 and 2050 base cases.

2. Loxahatchee NWR (WCA-1). The marsh dries out excessively downstream from the STA-1W inflow.

3. Holey Land. Starting Point water levels during high water periods are too high.

4. WCA-3B. The Starting Point predicts destructively high water in this area. If these predictions are accurate, it will be very important for future alternatives to bring water levels down.

5. Shark River Slough. Depths and hydroperiods in SRS have improved but remain too short under the Starting Point.

6. Central WCA-3A-S between Alligator Alley and the 3A-4 gage may suffer from over-drainage under the 2050 base and Starting Point conditions; however, this cannot be determined until the enhanced set of performance indicators become available.

Performance Measures and Indicators Used:

1. Stage duration curves for all indicator grid cells within Holey Land and Rotenberger Water Management Areas (WMAs), the WCA system, and the Pennsuco Wetlands. Figures that reported each model=s hydroperiod as part of the graph legend were used in preference to those that did not report this information.

2. Stage hydrographs for all indicator grid cells within Holey Land and Rotenberger WMAs, the WCA system, and the Pennsuco Wetlands.

3. Simulated water budgets for the WCA system and for WCA-3A.

4. Maps of assumed ground elevation for the SFWMM 3.4, and for NSM 4.5.

5. Maps of mean hydroperiod class for the entire period of record and for 1989 and 1995, for the 1995 base, 2050 base, Starting Point, and NSM.

6. Maps of ponding depth by class for all for models.

Recommendations:

1. The subteam recommends that future alternatives include components that will bring water depths closer to NSM patterns in WCA-2B.

2. The subteam recommends that future alternatives explore ways to maintain dry season water levels downstream from the STA 1W inflow.

3. Future alternatives should attempt to reduce high stages in the Holey Land while maintaining the lengthened hydroperiods predicted by the Starting Point. The subteam suggests that the new regulation schedule proposed by the GFC be evaluated as a possible way to achieve this.

4. The subteam recommends that future alternatives strive to increase hydroperiods in SRS beyond the modest improvements obtained from the Starting Point.

5. The subteam recommends that future alternatives attempt to avoid over-drainage of central WCA-3A.

Subteam Issues:

1. Technical issues:

    a. The team tentatively concluded that the unusual results, which include unrealistically deep water in WCA-3B for the 1995 base case, were the result of new topographic input data used in the model. Recent observations at tree islands and water gages by GFC and USFWS staff suggest that the model inaccurately predicts mean water depths. The team concluded that no conclusive evaluation of the Starting Point and bases case models can be made for WCA-3B, as well as for

other areas that may also have been influenced by the new elevational data, until the model calibration and validation issues are resolved.

b. Central WCA-3A-S between Alligator Alley and the 3A-4 gage may suffer from over-drainage under 2050 and Starting Point conditions; however, this cannot be determined until the enhanced set of performance indicators become available.

c. The new, enhanced performance measures are needed to evaluate model predictions for the freshwater marsh landscapes.

2. Non-technical issues:

a. Loxahatchee National Wildlife Refuge should be referred to as such instead of "WCA-1".

F. Estuaries and Bays Subregion

St. Lucie Estuary
Performance Based Comments:

The desirable total freshwater inflows from the contributing watersheds are based upon estimates of salinity requirements of the oyster and shoal grass indicator species. Historical flows, along with the recovery time of certain species, were evaluated to estimate the natural flow variation that should be allowed to exceed these suggested limits. The number of violations acceptable is defined as the targets for the performance measures. The results of the model simulation indicate that there was no significant difference between the Starting Point and 2050 base case in the number of times the salinity criteria were not met for the St. Lucie Estuary. The Starting Point model simulation did not significantly decrease the number of times the mean monthly base flow fell below the 350 cfs target. In addition, the number of consecutive months that the inflow did not meet the 350 cfs minimum did not improve. The Starting Point also showed no decrease in the number of times total mean monthly inflow exceeded 1600 cfs for 14 consecutive days as a result of regulatory releases from Lake Okeechobee.

Performance Measures and Indicators Used:

1. Number of times salinity envelope criteria were not met for the St. Lucie Estuary.

2. Number of times high discharge criteria (mean monthly flow > 1600 & 2500 cfs) were exceeded for St. Lucie Estuary.

Recommendations:

1. The subteam recommends that a baseflow from the C-44 basin equivalent to a 60 cfs mean monthly flow be provided to the estuary and all regulatory releases from Lake

Okeechobee are eliminated to meet the salinity targets for St. Lucie Estuary. Previous studies performed by the SFWMD indicate the need for the C-44 basin to contribute a minimum 60 cfs baseflow to the St. Lucie Estuary. This contribution was derived by directly proportioning the size of each basin to its contribution towards the total mean monthly flow minimum of 350 cfs.

2. Operational rules for a storage facility in the C-44 basin could be generated by the SFWMD using the Optimization model and the period of record rainfall. The Optimization model includes all 5 contributing basins and assumes all basin runoff is captured by the Starting Point storage facility or delivered to the estuary. As such, any operational rule developed by the Optimization model would assume no backflow to Lake Okeechobee.

Caloosahatchee Estuary

Performance Based Comments:

The results of the model simulations indicate that the Starting Point increased the number of times the salinity criteria were not met for the Caloosahatchee Estuary as compared to the 2050 base case. However, the Starting Point alternative decreased the number of times total mean monthly inflow from the C-43 basin exceeded 2,800 cfs but increased the number of times flow exceeded 2,800 cfs as a result of regulatory releases from Lake Okeechobee. However, the overall decrease in the number of times the total mean monthly flow to the Caloosahatchee Estuary exceeded the 2,800 and 4,500 cfs high discharge criteria does not appear to be significant.

Performance Measures and Indicators Used:

1. Number of times salinity envelope criteria were not met for the Caloosahatchee Estuary.

2. Number of times high discharge criteria (mean monthly flow > 2,800 and 4,500 cfs) were exceeded for the Caloosahatchee Estuary.

Recommendations:

1. The subteam recommends that a mean monthly baseflow of 300 cfs be provided through S-79 and that all regulatory releases from Lake Okeechobee be eliminated to meet the desirable salinity distributions in the Caloosahatchee Estuary. Preliminary studies performed by the SFWMD indicate the need for S-79 to contribute a minimum 300 cfs mean monthly baseflow to the Caloosahatchee Estuary.

2. The Lower West Coast Planning Division of the SFWMD could provide an operational rule for a storage facility in the C-43 basin. The operational rule was developed using the Optimization model and the period of record rainfall.

Lake Worth Lagoon

Performance Based Comments:

The performance measure showed that Starting Point reduced flow to the Lake Worth Lagoon. However, the target of no regulatory releases has not been met. There is no significant difference between the 2050 base and the Starting Point in the average wet season flows, although the 2050 base and the Starting Point did show a decrease in wet season flows from the 1995 base. The average dry season flows were reduced in the 2050 base and Starting Point although there is no significant difference between the 2050 base and Starting Point.

Performance Measures and Indicators Used:

1. Wet/Dry Season Average Flows Discharged to Lake Worth through S40, S41 & S155 for the 31 year Simulation

Recommendations:

1. Based upon previous studies done on the Lake Worth Lagoon, a mean monthly freshwater baseflow of roughly 150 cfs is needed to maintain estuarine conditions in the dry season.

Biscayne Bay
Performance Based Comments:

Overall, the Starting Point shows a 40% decrease in wet season flow and a 50% decrease in dry season flow from the 1995 base. The decrease occurs in all three regions of the Bay (North, Central, and South). The reduction is particularly a concern in the South bay where dry season flows are low and circulation with ocean water is most restricted. The reduction conflicts with the general stated target of "establishment of more estuarine conditions".

Performance Measures and Indicators Used:

This section under development.

Recommendations:

Evaluation of impacts of changes in flows to Biscayne Bay would be more accurate if Miami River (S25) flows were summarized separately from the North bay flows. In other words, four aggregated flows should be computed and shown in "Mean Annual Surface Flows Discharged to North, Central and South Biscayne Bay":

North:	S25B + S26 + S27 + S28 + S29
Miami River:	S25
Central:	S122 + S123 + S22 + G34 + S118
South:	S20F + S20G + S21 + S21A + A197

Florida Bay
Performance Based Comments:

An ecosystem restoration performance measure for the coastal basins between the mangrove estuaries and Florida Bay is to decrease the frequency that salinities exceed upper levels that have been identified for each basin through the conceptual model process. Another criterion is to increase the frequency that salinities drop below lower levels that have been identified for each basin.

The frequency of P33 monthly stage of 6.3 feet msl with the Starting Point fell short of the frequency that NSM exceeds this stage during approximately 92 months of the period of record. The frequency of P33 monthly stages above 7.3 feet msl with the Starting Point fell short of the frequency that NSM exceeds this stage for approximately 48 months of the period of record.

Performance Measures and Indicators Used:

This section under development.

Recommendations:

1. In order to decrease the frequency that coastal basin salinities exceed the upper limits identified for each basin, raise P33 monthly stages above 6.3 feet msl during approximately 92 months of the period of record when the NSM ver 4.5 exceeds that stage but the Starting Point does not.

2. In order to increase the frequency that coastal basin salinities drop below the lower limits identified for each basin, raise P33 monthly stages above 7.3 feet msl during the approximately 48 months of the period of record when NSM ver 4.5 exceeds that stage but the Starting Point does not.

Subteam issues:

1. Need to add a performance indicator of TSB stage hydrograph and stage duration curve.

G. Big Cypress Subregion

Performance Based Comments:

Two performance measures were available for two cells (R20, C13 and R17, C13) in the southeastern corner of the Big Cypress National Preserve. The target for successful restoration was that the performance measures match the NSM output.

There were no significant differences in stage hydrographs in cell R20, C13 for all four cases, NSM, the 1995 and 2050 bases and the Starting Point, for much of the period of record, and what differences there were showed no consistent pattern. The stage duration curves, however, did show a minor but consistent pattern of differences between the four cases. During high water periods (35% of the time) the 1995 base was higher than the other three cases, which were approximately similar to one another. When water levels were only slightly above the ground surface (35-55% of the time), all four cases were comparable. When the water table was below ground (> 55-65% of the time), NSM was similar to the 1995 base, the Starting Point was slightly higher than the 2050 base and both were higher than NSM and 1995 base. Thus, there was not a consistent optimal relationship between NSM and any one of the other three cases, although the mutual differences between them were not that great.

For the stage hydrograph in cell R17, C13, all three cases frequently missed the NSM wet season peak water levels, and they all tended to decline earlier in the dry season than did the NSM. The 1995 base was the least like NSM, 2050 base was closer and the Starting Point was closest to NSM. The stage duration curves showed a similar pattern of response, with the Starting Point being closer to the NSM than the 2050 base being closer to the NSM than the 1995 base. The three cases were closer to one another than they were to NSM. Thus, while there is still room for improvement, the Starting Point did show improvement over the 2050 base.

Considering the proximity of the two cells, it is difficult to see at this point why they are responding so differently to the four cases. The best explanation might be that the northernmost cell might be more affected by flows west of the L-28, and the southernmost cell affected more by flows from east of L-28. As additional model output becomes available for the cells proposed as indicator regions, the causes for the pattern variability will become clearer.

Other analysis included looking at the differences in hydroperiod, ponding depth, and peak water levels. When compared to the NSM, there were no significant differences among the three cases for ponding or hydroperiod. However, for the 2050 base case, ponding depth north of Tamiami Trail was similar to NSM conditions all across the southern end of WCA 3A, while in the 1995 base, it was wetter than NSM across the whole width of WCA 3A. This could have important implications for L-28 and how it may be managed.

Both the 2050 base and the Starting Point, individually and cumulatively, increased water levels for longer periods than the 1995 base in the area south of Tamiami Trail and southeast of Big Cypress. A comparison with NSM conditions was not available, so it was not possible to assess the significance of these changes.

Performance Measures and Indicators Used:

1. Stage hydrograph and stage duration curve for cell R20, C13.

2. Stage hydrograph and stage duration curve for cell R17, C13.

3. Hydroperiod differences maps.

4. Ponding depth differences maps.

5. Peak stage differences maps.

Recommendations:

1. A comparison with the NSM has been proposed for inclusion as an indicator for future alternatives in the area south of Tamiami Trail and southeast of Big Cypress.

H. Water Quality

Performance Based Comments:

The Starting Point is far from the salinity targets for the St. Lucie Estuary (many more low and high flow events than desired). Both the Starting Point and the 2050 base scenarios are moving away from the salinity target for the St. Lucie Estuary in terms of low flow events when compared to the 1995 base condition, and are not significantly improved in terms of high flow events.

The Starting Point is far from the salnity targets for the Caloosahatchee Estuary (many more low and high flow events than desired). The Starting Point is moving away from the salinity target for the Caloosahatchee Estuary in terms of low flow events when compared to 1995 base and 2050 base conditions. The Starting Point was better than the 1995 base and 2050 base conditions for high flow events, but was still an order of magnitude greater than the target in terms of frequency of events.

Performance Measures and Indicators Used:

1. Salinity envelopes for the Caloosahatchee and St. Lucie estuaries.

Recommendations:

1. In terms of reduced phosphorus loads to Lake Okeechobee, a storage/treatment feature in the Taylor Creek/Nubbin Slough basin north of Lake Okeechobee is desirable.

Subteam Issues:

1. Phosphorus related performance measures for the Everglades by which the effects of subsequent alternative plans can be expressed (in terms of output by the Everglades Water Quality Model) will be proposed.

Ecological / Water Quality Evaluations

A. Across Trophic Landscape System Simulation (ATLSS)

A single application of the ATLSS models was used for evaluating ecological improvement associated with the Starting Point. A measure of Cape Sable Sparrow "breeding potential," based on a comparison of the number of suitable habitat cells between the 2050 base and the Starting Point was made for select years from the period of record. This comparison suggested that there would be only small differences in the number and location of suitable habitat cells between the two scenarios. The small differences occurred in the wettest years, when the 2050 base was "...more conducive to successful breeding..." than was the Starting Point.

Emerging Issues

Nothing to report at this time.

Cumulative Evaluations

Nothing to report at this time.

Attachment 1

SUMMARY OF "REGIONAL" PERFORMANCE MEASURES

		Hydroperiod Match			Hydroperiod Improvement Relative to Future Base				Ponding Depth		
	Acres	STRPT	% > 95	% > 2050	STRPT	ac worse	ac improv	ac over	STRPT	% > 95	% > 2050
WCAs	842,240	76%	3%	1%	12%	54,000	101,000	89,000	62%	9%	-1%
LOX	145,920	75%	-6%	4%	7%	0	10,000	18,000	65%	5%	0%
2A	104,960	85%	-3%	0	0	2,500	0	2,500	83%	-7%	2%
2B	28,160	73%	9%	9%	0	10,000	0	15,000	0	-46%	-18%
3AN	204,800	66%	21%	1%	29%	34,000	59,000	31,000	75%	9%	4%
3AS	289,280	79%	-2%	1%	11%	5,000	31,000	20,000	66%	33%	0%
3B	69,120	85%	-4%	-4%	0	3,000	0	3,000	0	-26%	-11%
ROT	33,280	85%	85%	0	0	0	0	0	100%	31%	0%
HOL	35,840	36%	0	0	0	0	0	0	57%	-14%	0%
PEN	10,240	25%	25%	25%	25%	0	3,000	0	100%	75%	0%
ENP	486,400	73%	30%	24%	66%	5,000	320,000	18,000	99%	36%	22%
										0%	0%
Ever	1,356,800	74%	14%	9%	30%	56,000	412,000	105,000	75%	19%	8%
Marsh (SRS)					97%	0	146,000	5,000			